31 January 2000
NRL 5524

PURCHASE DESCRIPTION

CALIBRATOR, OSCILLOSCOPE

4777- REV B

1.0 GENERAL This procurement requires a calibrator to calibrate multichannel oscilloscope.

2.0 CLASSIFICATION The calibrator shall meet the requirements of MIL-PRF-28800F class 4 for Navy shipboard, submarine and shore applications.

3.0 OPERATIONAL REQUIREMENTS The calibrator shall have the capability to calibrate a 5 channel oscilloscope without the need to change hardware connections from channel to channel. The calibrator shall meet all the accuracy requirements specified herein when the operating temperature is maintained to within 23°C ±5°C. Outside of this range, a temperature coefficient of not more than [0.1 x stated accuracy/°C] is allowed. As a minimum the calibrator shall be capable of providing DC voltage, leveled sine wave, square wave, pulse, time marker, and edge functions to calibrate oscilloscopes with frequency bandwidth up to 500 MHz.

The calibrator shall have the capability to calibrate 5 channel oscilloscopes with higher frequency bandwidth. Calibration at higher frequency bandwidth can be purchased as an option as following.

Option 1: The calibrator shall have the capability to calibrate 5 channel oscilloscopes with frequency bandwidth up to 1GHz. The 1GHz bandwidth option shall have the same hardware and software platform of the base 500 MHz calibrator. All of the specifications for the 500 MHz calibrator shall be applicable to the 1GHz calibrator option except where it is otherwise noted. This option can be purchased with initial purchase of the calibrator or as an additional purchase for calibrator upgrading.

3.1 DC voltage The calibrator shall meet the requirements of Table I for sourcing DC voltage.

Table I: DC voltage

Impedance (Ω)	**Output** (V)	**1 Yr Uncertainty** (Tcal ±5°C)	**Sequence**
50	±1 mV to ±5 V	±(0.25% output + 40 µV)	1, 2, 5
1 M	±1 mV to ±130 V	±(0.25% output + 40 µV)	

3.2 Square wave The calibrator shall meet the requirements of Table II for sourcing square wave.

Table II: Square wave

Impedance (Ω)	**Frequency** (Hz)	**Output**	
		Range (Vpp)	**1Yr Uncertainty** (Tcal ±5°)
50	1 K	± 1 to ± 130	±(0.25% + 40µV)
1M			

3.3 Leveled sine wave The calibrator shall meet the requirements of Table III for sourcing leveled sine wave into 50Ω load.

Table III: Leveled sine wave

Frequency		Output		Flatness (Relative to 50 kHz)	Spectral purity
Range (Hz)	1 Yr Uncertainty (ppm)	Range (Vpp)	1 Yr Uncertainty (% of output at 50 kHz)		
50 k(REF)	±2	5 mV - 5 V	±(2% + 100 μV)	N/A	Harmonic: ≤ -30 dBc Non-harmonic: < -60 dBc
50 k - 100 M				±(1.5% output + 100 μV)	
100M - 500 M				±(3% output + 100 μV)	
500 M - 1 G (Option 1)		5 mV - 3 V		±(4% output + 100 μV)	

3.4 Edge function The calibrator shall meet the requirements in table IV for sourcing edge function into 50 Ω load.

Table IV: Edge function

Characteristics	Range	1 Yr Uncertainty (Tcal ±5°C)
Frequency	1 KHz - 2 MHz	±2.5 ppm
Amplitude	5.0 mVpp - 2.5 Vpp	±(3% of output + 100 μV)
Rise time	≤500 ps	
Rise time (Option 1)	≤150 ps	
Aberration	For first 10 ns	<(3% of output + 2mV)

3.5 Time mark The calibrator shall meet the requirements in Table V for time mark sourcing into 50 Ω load.

Table V: Time mark

Wave shape	Period	1 Yr Timing Uncertainty	Timing Jitter	Amplitude
Square	10 ns - 50 ms	±2 ppm	<1ppm (p-p)	100 mV to 1 Vpp
	50 ms - 5 s	±(2.5 ppm + 5 μHz)	<10 ppm(p-p)	
Pulse	1 μs - 50 ms	±2 ppm	<1ppm (p-p)	
	50 ms - 5 s	±(2.5 ppm + 5 μHz)	<10 ppm(p-p)	
Triangle	1 μs - 50 ms	±2 ppm	<1ppm (p-p)	
	50 ms - 5 s	±(2.5 ppm + 5 μHz)	<10 ppm(p-p)	
Sine	2 ns - 10 ns	±2 ppm	<1ppm (p-p)	

3.6 Input impedance measurements The calibrator shall meet the requirements in Table VI for impedance measurements.

Table VI: Input impedance measurements

Function	Range	1 Yr Uncertainty
Resistance	40 Ω - 60 Ω	±0.1%
	500 kΩ - 1.5 MΩ	±0.5%
Capacitance	5 pF - 50 pF	5% ± 0.5 pF

3.7 Overload measurements
3.7.1 Amplitude: 5 V - 9 V.
3.7.2 Duration: 5 s - 60 s.

3.8 Reference frequency The calibrator shall be capable of receiving external reference frequency as its time base.
3.8.1 Reference frequency input: 10 MHz.

3.9 External trigger The calibrator shall be capable of providing output signal for external trigger on the UUT.

3.10 Display Characteristics The unit shall be provided with a digital front panel display. The display shall provide a direct readout of the functions specified herein.

3.11 Calibration Software The oscilloscope calibrator shall have the inherent capability and necessary software to remotely calibrate UUT via an ANSI/IEEE-488 interface to a dedicated instrument controller or a personal computer operating in Microsoft Windows 3.1, Microsoft Windows 95, Microsoft Windows 98, and Microsoft Windows NT 4.0 environments. The software must adhere to ISO 9001 paragraphs 4.11 a through j. Currently available software and procedures shall be shipped with each unit in CD format.

3.11.1 Procedure database: The software shall include the oscilloscope calibration procedures currently available to the commercial market. The software shall also include a calibration procedure for the oscilloscope calibrator.

3.11.2 Software: The software shall include drivers and programming languages to allow the operator to modify existing procedures and to write and store on disk new calibration procedures. The software shall also include a database and an editor to store calibration results and generate calibration certificates.

3.11.3 Software and procedure upgrades: Throughout the life of the contract once every six months the calibrator shall have the calibration procedures and software upgraded to the latest version available on the commercial market. Throughout the life of the contract, if requested, the manufacturer shall develop calibration procedures to support oscilloscope purchased under the Navy GPETE program. The new procedures shall be developed and delivered within six months upon receiving request from the Contracting Officer. Throughout the life of the contract the maximum number of new calibration procedures that the manufacturer has to develop is ten. Software and procedure upgrades shall be shipped in CD format to a focal point to be determined by the Contracting Officer.

3.12 Rackmount The calibrator shall meet the convertible/rack-mountable requirements of MIL-PRF-28800F.

4.0 GENERAL REQUIREMENTS

4.1 Warm-up The required warm-up time shall not exceed 30 minutes.

4.2 Temperature

4.2.1 Operating temperature 5 °C to 40 °C.

4.2.2 Non-operating temperature 0 °C to 50 °C.

4.3 Power sourceMIL-PRF-28800F nominal power source requirements are invoked. Maximum power consumption:500 W.

4.4 Weight The calibrator and accessories, excludes manuals and transit cases, shall have a maximum weight of 20 kg (44 lbs).

4.5 Remote interface The calibrator shall be provided with an ANSI/IEEE-488 interface in accordance with MIL-PRF-28800F. The interface shall be provided with full subset capability for the purposes of controlling the calibrator remotely and performing closed-loop calibrations. The calibrator shall be provided with all necessary accessories.

4.6 Accessories The calibrator shall be supplied with all leads, cables, adapters, terminations and any other accessories necessary for full use of the calibrator.

4.7 Optional transit case The calibrator shall be supplied with a hard transit case as a line item option. The hard transit case shall have provisions for stowage of the calibrator, the accessory case, and at least the Operator's manual. The transit case shall comply with the requirements of the MIL-PRF-28800F performance specification.

4.8 Training A multimedia CD showing the features and basic operation of the calibrator shall be provided with each unit. The multimedia CD shall have hot links to allow end user promptly link to a desired section.

4.9 Battery restrictions Per MIL-PRF-28800F, lithium and mercury batteries are prohibited without prior authorization. A request for approval for the use of lithium or mercury batteries, including those encapsulated in integrated circuits, shall be submitted to the procuring activity at the time of submission of proposals. Approval shall apply only to the specific model proposed.

4.10 Calibration Interval: The calibration interval shall be 12 months minimum as in accordance with MIL-PRF-28800F.

4.11 Technical manual Technical manuals shall be conformed with standard MIL-PRF-28800F. A Use and Installation manual (Operator's Manual) shall be provided separately. Maintenance and Servicing manual shall be provided with all three levels of maintenance; unit operational verification, module level, and component level. Technical manuals shall be provided in both printed and electronic formats. The printed format shall be otherwise normally provided. The electronic format shall consist of the installation programs for the latest version of Adobe Acrobat for all computer platforms for which Acrobat is available and the technical manual in an electronic form that is readable through use of the Adobe Acrobat application.

4.12 Year 2000 Compliance The manufacturer shall certify that the calibrator is not succeptible to malfunction as a result of date/time functions associated with the calendar year 2000 or later.